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Marshall Space Flight Center



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Dual Field Alignment Display and Control for Electron Micropattern Generator

The photolithography process used in the fabrication of integrated circuits may soon be replaced by electron beam lithography. Two principal electron beam systems used in the new process will be the electron micropattern generator for generating device patterns and the electron image projection system for reproducing these patterns. The electron micropattern generator (EMG) is an adaptation of a scanning electron microscope to digital or computer control to generate the patterns.

Planar devices such as integrated circuits require successive patterns to be precisely positioned with reference to each other. Thus, adequate registration is of prime importance when generating or duplicating the patterns. A method has been developed to align an electron micropattern generator that is used to write device patterns at final scale with a computer controlled electron beam. In this method two digitally prescribed index addresses for

the pattern are aligned with a pre-existing index or with fiducial feature on the target substrate. An alignment oscilloscope simultaneously displays the index on the target and the alignment index. Pattern position, rotation, and size are adjusted electronically so that accurate registration is obtained. Figure 1 is a block diagram of the display system, and Figure 2 illustrates how the indexes are used to align the patterns. This adjustment is greatly facilitated by the simultaneous display of both alignment areas.

Completely automatic alignment is required for unattended electron micropattern generator operation; however, the manual method requires less hardware and is useful for both limited pattern production during device and process development studies and as an independent check on alignment quality when using an automatic method. The alignment is automated by the substitution

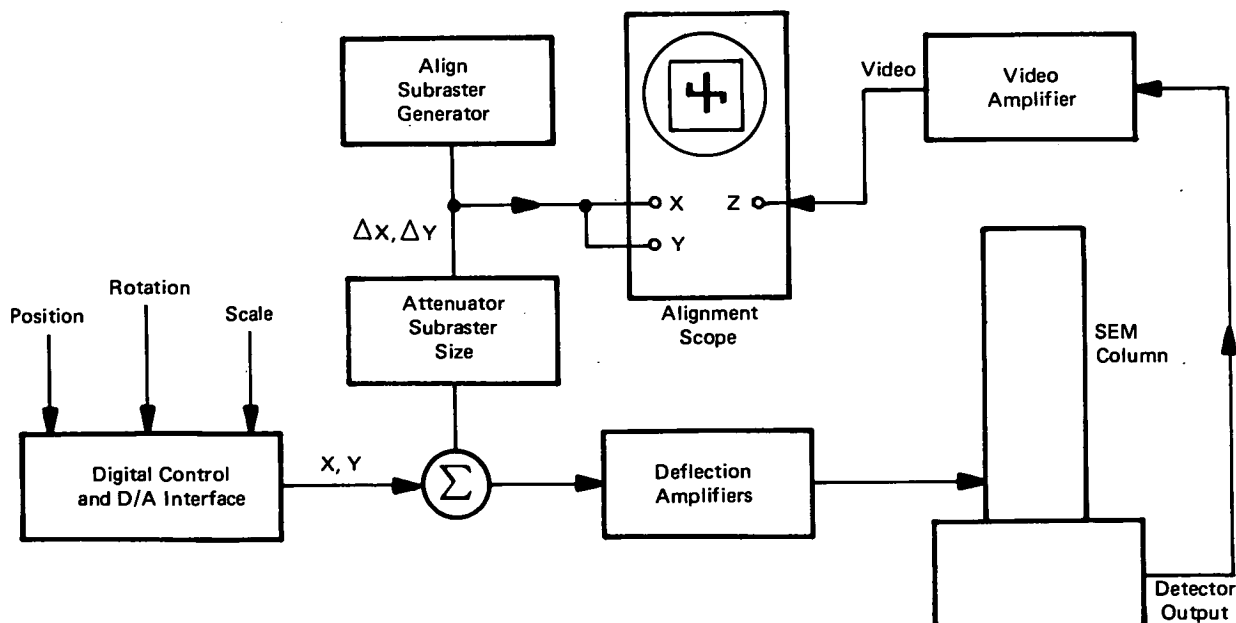


Figure 1. EMG Pattern Alignment Display System

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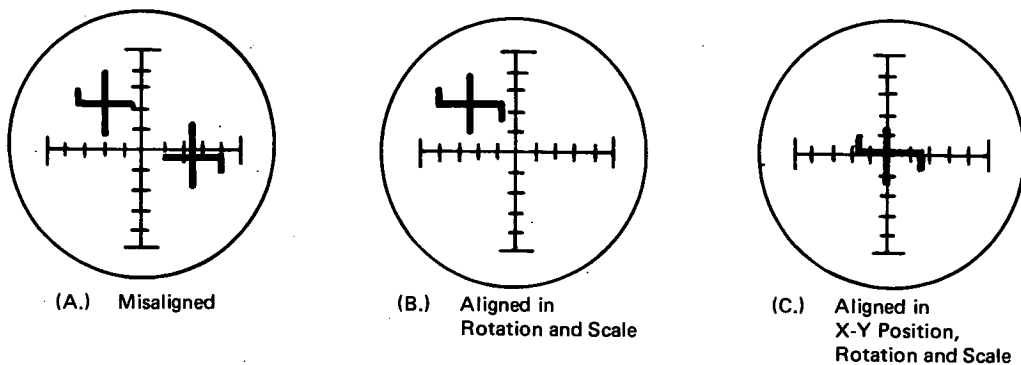


Figure 2. Pattern Alignment Scope Presentation

of alignment error-controlled, up-down counters coupled to digital/analog converters for the position-rotation-size controls currently used.

Notes:

1. Information concerning this innovation may be of interest to manufacturers of solid state devices such as integrated circuits, high frequency transistors, and high density memory arrays.
2. Requests for further information may be directed to:
Technology Utilization Officer
Marshall Space Flight Center
Code: A&PS-TU
Marshall Space Flight Center, Alabama 35812
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Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

Patent Counsel
Marshall Space Flight Center
Code A&PS-PAT
Marshall Space Flight Center, Alabama 35812

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